e-palli

AMERICAN JOURNAL OF INTERDISCIPLINARY RESEARCH AND INNOVATION (AJIRI)

VOLUME 1 ISSUE 1 (2022)

INDEXED IN

doi Crossref Google Scholar Directory of Research Journals Indexing DRJI

PUBLISHED BY: E-PALLI, DELAWARE, USA

American Journal of Interdisciplinary Research and Innovation (AJIRI)

Volume 1 Issue 1, Year 2022
ISSN: 2833-2237 (Online),
DOI: https://doi.org/10.54536/ajiri.v1i1.439
https://journals.e-palli.com/home/index.php/ajiri

Assessment of Rice Blast (*Pyricularia Grisea*) Disease Under Different Concentrations of Nitrogen on Different Rice Cultivars

Joshi A[1*], Chandra Prasad Pokhrel[2]

Article Information

Received: July 28, 2022

Accepted: August 2, 2022

Published: August 3, 2022

Keywords

Rice Blast, Concentration of Nitrogen, Rice Varieties

ABSTRACT

Rice is a staple food contributing high calorie intake to humans. In Nepal, rice contributes 39% of GDP, among agricultural crops. Blast disease (Pyricularia grisea Sacc.) has been a continuous threat to rice production. This disease causes 10-20% yield reduction in susceptible varieties, whereas in severe case it causes upto 80%. Excessive nitrogen increases N-metabolism in plant, leading to enhanced tissue susceptibility to blast disease. Farmers' household survey was carried out in Mangalpur V.D.C. ward no. 1, Chitwan during March, 2013, for determining the knowledge and perception of rice blast incidence and severity, their constraints in rice cultivation and their practices, knowledge on the disease management and amount of fertilization use. Similarly, a field experiment was carried out during June to September, 2013 to assess the impact of different concentrations of nitrogen on rice blast disease (caused by Pyricularia grisea Sacc.) incidence, severity and their effect on yield of Mansuli, Aekle and O.R. varieties of rice. Four treatments (0 kg/ha, 100 kg/ha, 200 kg/ha and 300 kg/ha) were used in RCBD with 3 replications in three different cultivars. In the field experiment, disease incidence and severity varied significantly ($P \leq 0.05$) among the treatments. The highest incidence and severity for both were observed from higher concentration of nitrogen in Mansuli variety (42.22% and 53.43%, respectively), whereas the lowest observed from no nitrogen in Aekle variety (25.56% and 24.32%, respectively) on 69 days after transplantation. Significantly highest yield (5.217 t/ha), number of grains per panicle (182.3) and 1000 grains weight (32.45 gm) were also obtained at no nitrogen. Among three varieties, Mansuli was the susceptible variety and Aekle was resistance variety.

INTRODUCTION

"Rice is life" the theme of international year of rice, 2004 that reflected the importance of rice (Oryza sativa L.). Rice is a staple food of nearly one-half of the world's population contributing high calorie intake to humans. In Asia, more than 2,000 million people obtain 60-70% of their calories from rice and its products. About 80% of the world's rice is grown by small scale farmers in low income and developing countries (NARC, 2000).

Rice is the most important cereal crop in Nepal, which is cultivated on 1.5 million hectare across diverse geographic regions ranging from low land terai (<100 masl) to high hills (3,000 masl) (NARC, 1997). In Nepal, rice contributes 39% of GDP, among agricultural crops; rice is the main crop, cultivated on nearly 1.54 million hectares of land. Total production of rice in (2009/2010) was 4.13 million tons, with an average productivity of 2,675 kg/ha (MoAC, 2010). The productivity of rice in Nepal is very low as compared to other rice producing countries like Egypt, Japan, South Korea and Australia i.e. 9.5 t ha-1, 6.9 t ha-1, 6.76 t ha-1 and 8.2 t ha-1 respectively (FAO, 2005). This is almost four times greater than that of Nepal. It has been estimated that annual rice production must increase from 3.7 million tons in 1997, to over 5 million tons by the year 2020 (NARC, 1997) to meet the increasing demands. With this projected increase, the constraints on water resources will be further aggravated since most of the rice is produced with irrigation. The available water for irrigation however is searching because of decreasing resource and quality and increased competition from non-agricultural water users. For food security, it is essential to "produce more rice with less water" (Stoop et al., 2002).

Blast disease [Pyricularia oryzae (Synonym P. grisea Sacc.,), telomorph Magneporthe grisea] a cosmopolitan disease of rice (Oryza sativa L.) has been a continuous threat to rice production (Manandhar, 1987; Manandhar et al., 1992). Effect of nitrogen on disease development is the ultimate result of research concerning the interaction between blast disease and mineral nutrients. Several studies have shown that excessive nitrogen increases N-metabolism in plant, leading to enhanced tissue susceptibility to blast disease (Ou, 1985)

Blast disease is world widely distributed. Till now disease has reported from more than 133 countries. Estimated yield loss is 5% in tropics (CGIAR, 1996). In East Asia, rice blast is most common and destructive disease in irrigated rice of both temperate and sub-tropical areas (Bonman et al., 1991). This disease was divided into leaf and panicle pathosystem (Teng et al., 1991) which attacks on leaves, stem nodes, all parts of the panicle and grains . Disease is severe in seedlings stage and at tillering and heading stages of crop with great economic loss. Plants got highest disease at maximum tillering stage then gradually declined, mainly due to adult plant resistance (Koh et al., 1987).

Rice blast has long been recorded in Nepal (Khadka & Shah, 1967). This disease causes 10-20% yield reduction in susceptible varieties, whereas in severe case it causes

[1] Trivuwan University (Birendra Multiple Campus), Nepal.
[2] Central Department of Botany Tribhuvan University Kathmandu, Nepal.
[*] Corresponding author's e-mail: raazstha44@gmail.com

up to 80% (Manandhar et al., 1992). Further, Chaudhary (1996) has reported a reduction of grain and straw yields 67% and 40% respectively and about 67% sterility of panicle (Teng et al., 1991). Yield reduction by neck blast infection is twice as severe as leaf blast (Hwang et al., 1987). More recently, a grain yield loss of 38.5 and 76.0 kg ha-1 was reported in rice cultivars: 'Mansuli' and 'Radha-17' respectively due to one percent increase in neck blast (Chaudhary 1999).

Plant acquires nitrogen from two major pools: soil and the atmosphere. Nitrogen from the soil is usually taken up as nitrate, whereas atmospheric molecular nitrogen is incorporated through the symbiotic fixation by micro-organisms (Mylona et al., 1995). Irrespective of the source, in higher plants inorganic nitrogen must eventually be reduced to ammonia before it can be assimilated (Lea, 1992). Ammonia is incorporated into glutamine, glutamate, aspartate and asparagines which are the predominant nitrogen carrying molecules in plants (Lam et al., 1996). Nitrogen supply can affect disease development. High concentration of nitrogen often increases susceptibility of plants to diseases (Agrios, 2006). The main objective of this research is to assess the effect of different concentrations of nitrogen on leaf blast disease of different rice cultivars.

METHOD

The study basically consisted of two main parts: farmers' household survey and field experiment as below

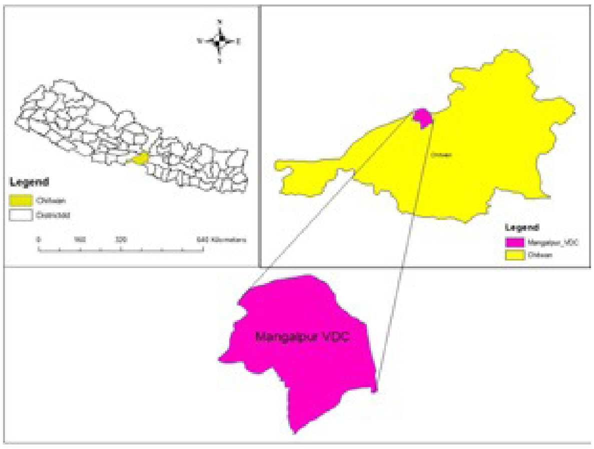
Farmers' survey

A survey was conducted to find out the crop losses due to diseases especially rice blast (Pyricularia grisea Sacc.), extent of damage, farmer perception and management practices against the disease. Thirty sample households were selected randomly from the main rice growing areas of Mangalpur VDC, Chitwan. Survey questionnaire (semi-structured) was prepared to collect necessary information. Heads of 30 households were selected for interview. In absence of household head the next senior of the household was taken as the respondent. Collected information's were tabulated, analyzed, interpreted and conclusions were drawn.

Field experiment

Experimental sites

The research was conducted at Mangalpur-1 of western Chitwan. The site is in sub- tropical zone with an altitude of 256 meters above mean sea level between 27038' N latitude and 84024' E longitudes and 7 km west from Bharatpur; headquarter of Chitwan district. Chitwan district is central region of Nepal which lies in the west part of Narayani zone. It covers an area of 2,128 km2 and had the population of 579,984 in 2011. Land preparation was done by plowing with plough. Soil was fertilized with farm yard manure @ 6 tons / ha and urea and DAP @ 120:60 kg/ ha respectively. The seeds obtained from farmers were sown uniformly in the field.



Agrometeorological features

The meteorological information like maximum and minimum temperature, rainfall and relative humidity were received from National Maize Research Centre, Rampur, Chitwan. The site is 2 km away from the station. The weekly mean maximum and minimum temperature, rainfall and relative humidity during the crop growing seasons.

Detail of Experiments

The experiment was laid out in randomized complete block design (RCBD) with three replications in three different cultivars i.e. Mansuli, O.R. and Aekle. Individual plot size was comprised of 3m×3m. Treatments of different concentration of nitrogen were given to each plot as follows:

- T0: No Treatment
- T1: Required concentration of Nitrogen i.e. 100kg/ha
- T2: Moderate concentration of Nitrogen i.e. 200kg/ha
- T3: High concentration of Nitrogen i.e. 300kg/ha

N:P:K was applied @100:30:30 kg/ha for normal concentration. Half amount of nitrogen and total amount of Phosphorus and Potash was mixed in the soil at the time of land preparation. Remaining half of nitrogen was applied in two split doses; one at 28 days after sowing (DAT) and the other at 42 DAT. Weeding, sanitation were done to each plot as the requirement.

Laboratory experiment

Collection of disease sample

The infected leaf samples were collected in the brown paper envelopes from each plot and brought to the laboratory and kept in refrigerator.

Isolation of pathogen

The pathogen (Pyricularia grisea Sacc.) from blast infected leaves of rice from each plot was isolated separately at Plant Pathology Laboratory, Central Department of Botany, Kirtipur. The infected part of the collected leaf samples was cut into small pieces (about 2mm long with scissors). The pieces were surface sterilized with 1% sodium hypochloride for 1 minute, followed by two successive cleaning with distilled water,

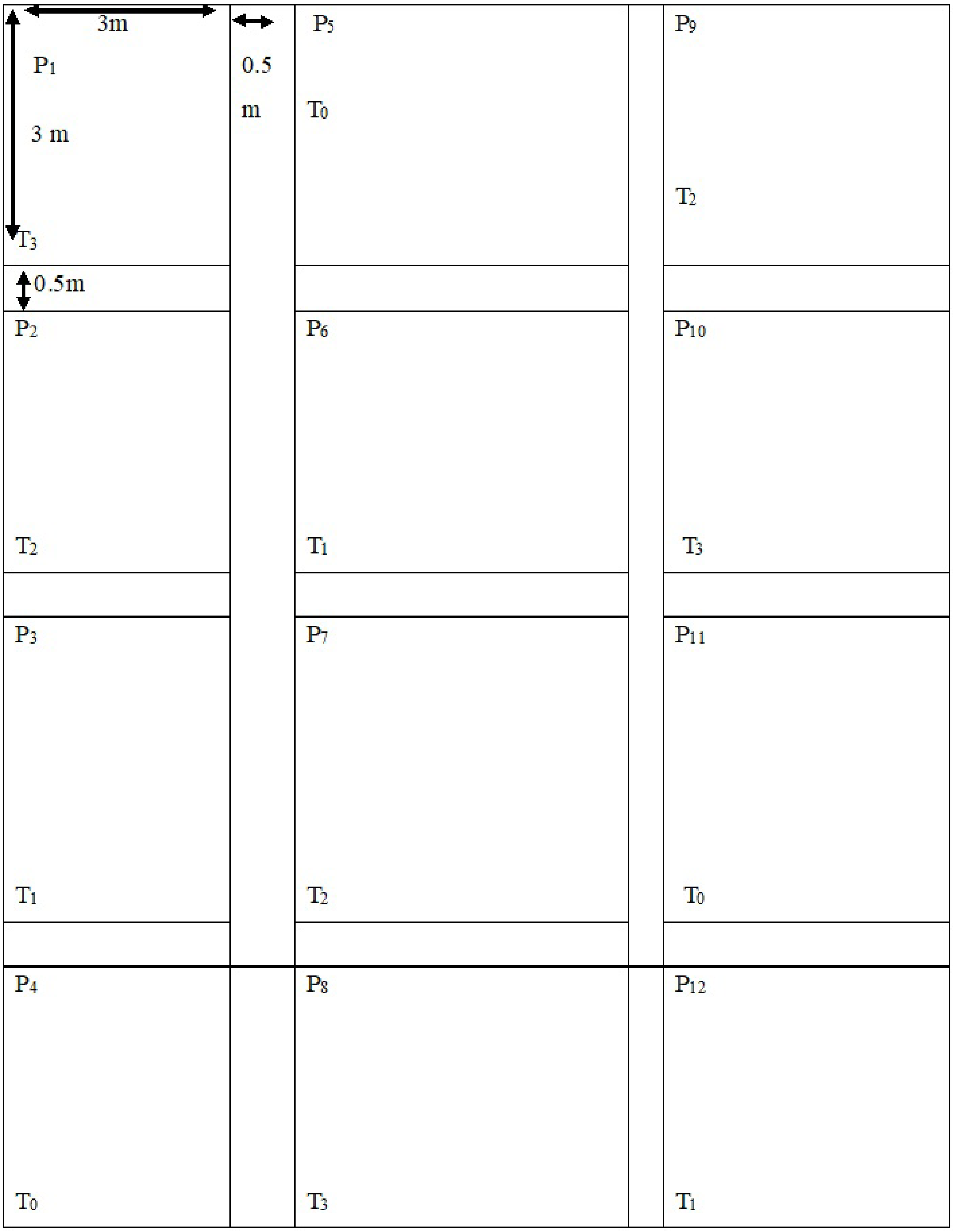


Figure 2: Field layout Randomized Complete Block Design (RCBD)

and put in clean, sterile Petridis, containing three layers of moistened blotting paper with distilled water. The samples were incubated at 250C to 260C for 24 hours. From the sporulating lesions, single spore was transferred to the slant culture tubes containing pure agar. The single spore isolate was obtained by spreading conidia from the discrete lesions on water agar with the help of inoculating needle under stereomicroscope. Germinating conidia were transferred aseptically to potato dextrose agar plates one by one 12 hours after spreading. The plates were incubated at 25±20C for 3-4 days.

Cultural behavior of pathogen

Radial mycelium growth (RMG) and days of sporulaton (DOS) of P. grisea were studied by culturing on Potato dextrose agar (PDA) at Central Department of Botany, T.U., Kirtipur. Pure culture of the isolates was prepared as described above. Fungal blocks of 5mm diameter were cut from pure culture. A single block of each isolate was placed at the center at the center of each Petridish. Cross lines with semi permanent board markers were drawn on the undersurface of the lower plate along with the center of the fungal block each plate was wrapped with parafilm tape to protect from contamination and the plates were incubated in the room of laboratory at ambient temperature.

Observation

The in vitro observation was done and RMG of the colonies was recorded at nine days after incubation. The diameter of the fungal colonies was measured with the measuring scale. The inoculated petridish were incubated under continuous fluorescent light for sporulation as described above. Production of spore was detected by microscopic observation from five days after incubation at the interval of two days upto 30 days after inoculation.

Statistical analysis

The data were analyzed by using Microsoft Excel 2007 and SPSS version 20.0. Analysis of Variance (ANOVA) was used to determine the level of significance between the means of different yield attributing characters. Simple correlation coefficient and regression analysis were done.

RESULTS

The results consist three sections: i) Survey details of farmers profile, occupation status, landholding, cropping pattern, family size, problem related to rice farming, educational status, farmers' perception on rice blast (Pyricularia grisea Sacc.), its epidemics, pesticides use, source of information and disease management practices, ii)assessment of rice blast (Pyricularia grisea Sacc.) in different nitrogen concentration and iii) laboratory study of Pyricularia grisea Sacc. Behavior.

Farmers' household survey

A farmer survey was carried out for determining the knowledge and perception of rice blast incidence and severity, their constraints in rice cultivation and their practices, knowledge on the disease management and amount of fertilization use. All respondents of the survey were above 20 years with majority 26-45 years age of category followed by above 45, majority were intermediate (25%) and the least being the Bachelor holders (9%), half of the respondents were solely dependent on agriculture and remaining engaged on other business activities along with agriculture.

The major problems faced by the farmers in rice production were disease, insects/animals and irrigation facilities where diseases were ranked first by farmers (39.17%) followed by insects/animals (22.17%) but 32.86% respondent ranked second for insects/animals. Other major problems were irrigation facilities followed by labour problems. Among different disease of rice, most of the farmers were known only about blast disease. About two third of the respondents (64%) responded that the blast disease (Pyricularia grisea Sacc.) is most problematic disease and about one third of the respondent (36%) responded that brown spot of rice, bacterial blight, foot rot, etc. More than two third of the respondents (74%) responded that the blast disease (Pyricularia grisea Sacc.) infest all stages of crop after transplanting. About one third (26%) of the farmers responded that the disease attacks more in panicle at ripening stage of rice. Over half of the farmers (57%) responded that the susceptible variety was the most prone condition to the blast (Pyricularia grisea Sacc.), followed by excessive nitrogen used area (32%), planting density (8%) and water level (3%).

73% of the total respondents responded that the blast disease (Pyricularia grisea Sacc.) severity was the most during hot and rainy weather and only 27% responded severe during dry and hot weather.

90.74% of the farmers used only pesticides to control this disease however only few respondents (9.26%) did not use any pesticides since 4 years in all the crops. The pesticides used by the farmers were: Bavistine, Tricyclazole, Hinosan, etc. Farmers used pesticides 2-3 times per season (range 0 to 5). All of the farmers got the pesticides from the agro-vets.

Field experiment

Starting from 34 days after transplantation (DAT) i.e. on August 12 disease observations were taken for five times in 7 days interval and disease incidence were calculated for different treated plots. Disease incidence varied significantly higher ($P \leq 0.05$) among the treatments. Highest incidence was observed for higher concentration of nitrogen of Mansuli variety i.e. 26.67, 30.00, 35.56, 37.78 and 42.22. Similarly lowest disease incidence was observed for no concentration of nitrogen of Aekle variety i.e. 6.67, 12.22, 16.67, 22.22 and 25.56 (figure 3). Significantly highest disease severity was observed on Mansuli rice variety in highest concentration of nitrogen i.e. 36.67, 40.67, 47.50, 52.03 and 53.43. Similarly significantly lowest disease severity was observed on Aekle variety in no concentration of nitrogen i.e. 13.33, 20, 27.5, 32 and 26.32 (figure 4). At 64 DAT, the AUDPC value was significantly highest in Treatment 3 (highest nitrogen concentration) of Mansuli variety (369.11), followed by Treatment 2 (moderate nitrogen concentration) of O.R. variety (327.11) and significantly

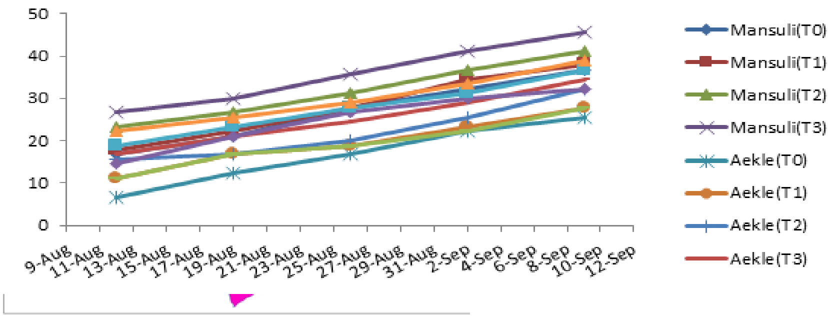


Figure 3: Blast disease incidence (%) on leaves of rice under 4 treatment in field.

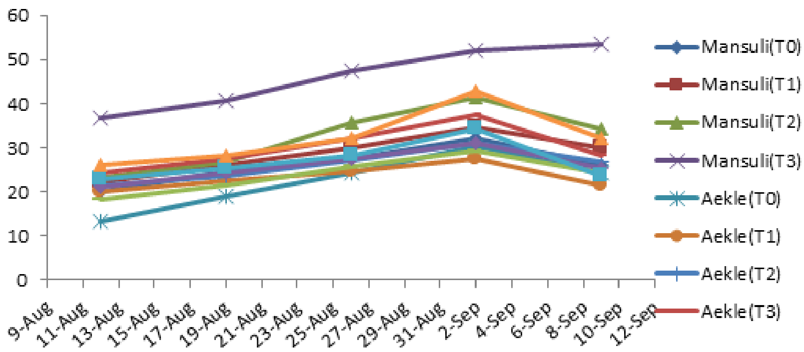


Figure 4: Blast disease severity (%) on leaves of rice under 4 treatments in field.

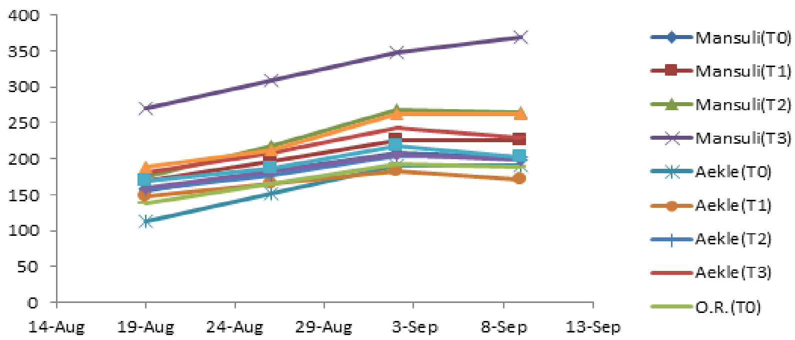


Figure 5: Total AUDPC observed on leaves of rice under 4 treatments in field.

lowest ($p \leq 0.05$) total AUDPC was observed for no concentration of nitrogen of Aekle variety i.e. 702.275 and significantly highest ($p \leq 0.05$) total AUDPC was observed for high concentration of nitrogen of Mansuli variety i.e. 1296.645 (Figure. 5).

Effect on yield and yield attributes

Rice blast disease severity and its effect on yield and yield attribute i.e. panicle length, flag leaf length, grains per panicle and test weight (1000 grain weight) were assessed during the field experiment which is presented in Table 1. The result showed that there was significant effect for different treatments for yield and yield attributes i.e. grains per panicle, test weight, panicle length, and flag leaf length.

Rice blast disease severity and its effect on yield and yield attributes i.e. panicle length, flag leaf length, grains per panicle and test weight (1000 grain weight) were assessed during the field experiment.

Significantly highest ($p \leq 0.05$) yield was given by the plot treated with no N treatment (5.217 t/ha), followed by required amount of nitrogen treatment (100 kg/ha), moderate concentration of nitrogen (200 kg/ha) and high concentration of nitrogen (300 kg/ha) showed 4.083 t/ha, 3.687 kg/ha and 2.887 kg/ha.

There was significant effect of various treatments on grains per panicle. The lowest grains per panicle of rice was observed on high concentration of nitrogen than all treatments (122.02) while the highest significant grains per panicle of rice was observed on no N treatment than all treatments (182.30).

There was significant effect of various treatments on test weight. The mean value of test weight of rice on high concentration of nitrogen is lowest than all treatments (23.53 gm.) while the mean value of test weight of rice on no treatment is highest than all treatments (32.45 gm.).

The mean value of flag leaf length of rice on high concentration of nitrogen is lowest than all treatments (22.87 cm.) while the mean value of flag leaf length of rice on no treatment is highest than all treatments (30.27cm.) which is statistically significant ($P \leq 0.05$).

The mean value of panicle length of rice on high concentration of nitrogen is lowest than all treatments (23.01 cm.) while the mean value of panicle length of rice on no treatment is highest than all treatments (28.67cm.) which is statistically significant ($P \leq 0.05$).

Table 1: Mean of yield and yield attributes after ANOVA.

Yield attributing characters	SS	df	MS	Mean±SE	F	p (Significance)
Area Under Disease Progress Curve	48670.141	3	16223.380	205.16±7.21	10.371	0.00
Flag Leaf length (cm)	92.517	3	30.839	26.31±3.19	12.373	0.002
Panicle length (cm)	51.228	3	17.076	25.68±0.82	3.773	0.05
Grains per panicle	5845.46	3	1948.487	146.707±8.53	4.135	0.04
Test weight (gm.)	136.593	3	45.531	26.820±1.30	4.193	0.047
Yield (t/ha)	8.463	3	2.821	3.96±0.324	4.131	0.048

The mean value of panicle length of rice on high concentration of nitrogen is lowest than all treatments (23.01 cm.) while the mean value of panicle length of rice on no treatment is highest than all treatments (28.67cm.) which is statistically significant (P≤0.05).

Correlation between total AUDPC and yield and yield attributes

There was significant (p≤0.05) linear negative correlation between total AUDPC and Yield. Total AUDPC contributed 59.8 % (R2=0.598) decrease in overall yield.

There was significant (p≤0.05) linear negative correlation between total AUDPC and test wight in gm. Total AUDPC contributed 65.8 % (R2=0.658) decrease in test weight.

There was significant (p≤0.05) linear negative correlation between total AUDPC and Grains per panicle. Total AUDPC contributed 5.2 % (R2=0.052) decrease in grains per panicle.

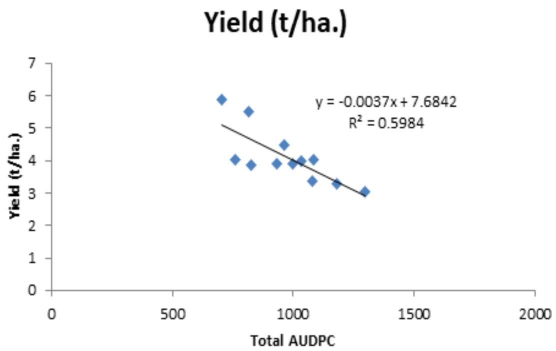


Figure 6: Relationship between total AUDPC and Yield at experimental site

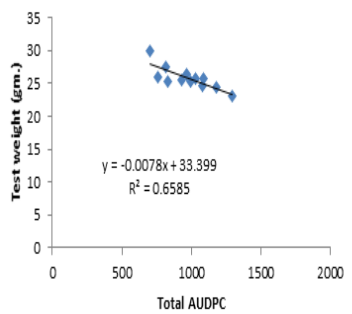


Figure 7: Relationship between total AUDPC and Test weight at experimental site

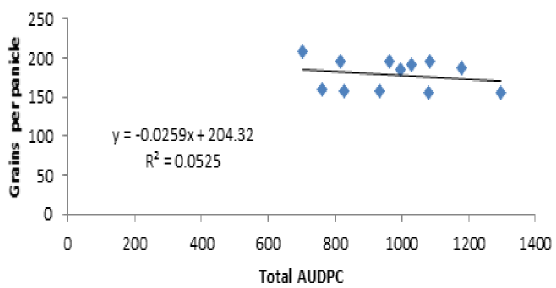


Figure 8: Relationship between total AUDPC and Grains per panicle at experimental site.

Morphology of Pyricularia grisea

The shape of the conidia was pyriform to obclavate (18.9-26.8 µm ×7.8-9.9 µm length/width), three celled (mostly two septated), with small basal hilum and acrogenous. The fungus was propagated through conidiophores. Conidiophores were grey in colour, single or in fascicles, usually simple and showing sympodial growth, geniculate towards apex, with swollen base. The radial mycelium growth was about 45 mm in an average. The isolates of the pathogen Pyricularia grisea Sacc. was grown in PDA for the study of mycelium growth from rice blast, were further incubated for observation of sporulation in vitro. Average days of sporulation (DOS) calculated for PDA media was 20 days

DISCUSSION

Farmers' survey

This study shows that majority of the respondents of the surveyed area was intermediate (28%) followed by literate (23%). The most serious disease for heavy damage to rice plant and major constraint of rice production in Chitwan is blast disease caused by Pyricularia grisea. Similar findings were also reported in Nepal (NARC, 2007) and in the world RPPL (2001). The major problems faced by the farmers in rice production were disease, insects/animals and irrigation facilities where diseases were ranked first by farmers (39.17%) followed by insects/animals (22.17%) but 32.86% respondent ranked second for insects/ animals. So diseases and insects/pests were the major problem in rice cultivation in Chitwan and this was also reported by RPPL (2001) and NARC (2007). Majority of the respondents (73%) had the perception that the rice blast severity was higher in hot and rainy weather. This is in line with the work done by (NARC, 2007), and was observed that it was the only serious disease during the spring season rice. Similarly, RPPL (2001) found that a population of this disease was more abundant from spring to early summer in Chitwan.

Our study shows that 90.74% of the farmers used only pesticides to control this disease however only few respondents (9.26%) did not use any pesticides since 4 years in all the crops. The pesticides used by the farmers were: Bavistine, Tricyclazole, Hinosan, etc. Similar approaches such as Tricyclazole significantly superior in decreasing leaf and neck blast and increasing the number of tillers there by increasing the yield attributes have been proved by various researchers (Tirmali et al., 2001; Sharma et al., 2002; Gohel et al., 2009 and Dubey, 2005). Similarly, Kasugamycin and Isoprothiolane also controlled leaf and neck blast (Anwar et al., 2005; Mandal et al., 2008). Farmers use different chemical pesticides for the reduction of the disease in Nepal which is hazardous to growers and consumers and also creates environmental pollution (NARC, 1998; Maharjan et al., 2004).

From the survey, over half of the farmers (57%) responded that the susceptible variety was the most prone condition to the blast (Pyricularia grisea Sacc.), followed by excessive nitrogen used area (32%), planting density

(8%) and water level (3%). Similar field experiment have been conducted in which nitrogen levels (0, 50, 100 and 150 kg/ ha) were placed in a plot and the incidences of rice blast in seeds as well as the panicle disease severity were significantly higher in plants fertilized with N was resulted (Bragantia, 2010).Blast, has been a continuous threat to rice production Nepal (Manandhar 1987, Manandhar et al., 1992, Chaudhary 1996). In Nepal, the disease causes the 10-20% yield reduction in susceptible varieties, but in severe case it goes upto 80% yield reduction (Manandhar et al., 1992).

Disease incidence and severity

This research shows that the interaction between N treatments and disease severity was highly significant. The means from the field experiment showed that Increase in N application significantly increase leaf blast compared with no N treatment (figure 9). In the field experiment, disease incidence varied significantly among the treatments of nitrogen application. Highest incidence was observed in high concentration of nitrogen in Mansuli variety of rice. Similarly lowest disease incidence was observed in no concentration of nitrogen of O.R. variety. The high concentration of nitrogen causes water deficit and low silicon consumption resulting to the increase in susceptibility of rice to blast disease. The situation is also suitable for disease severity which significantly varied between treatments. Highest incidence was observed in high concentration of nitrogen in Mansuli variety of rice. Similarly lowest disease incidence was observed in no concentration of nitrogen of Aekle variety. Blast disease and mineral nutrients are principally interrelated especially the effect of nitrogen on disease development is much important. Excessive availability of nitrogen increases N-metabolism in rice plant, leading to enhance tissue susceptibility to blast disease. Several researches have been carried out regarding the effect on nitrogen on disease development. Frequency and timing of N application had a much greater influence on leaf blast (Dos Santos et al., 1986; Kurschner et al., 1992). Sridhar (1972) reported that increase in susceptibility to leaf blast occurred in both highly and moderately susceptible cultivars; however, our data suggest that susceptible cultivars are at a higher risk for leaf blast epidemics than are the more resistant cultivars.

AUDPC values varied significantly among the treatments. The values progress upto 50 DAT and then declined in most of the treatments. This is similar to a simple unimodal disease progress curve that describes leaf blast development on most of the susceptible cultivars, in that leaf blast, whether measured as disease severity or as total lesions per plant, increased from low level early in the season to the highest level at midseason and then decline gradually thereafter. Roumen which reported that leaf infections on maturing rice plants (reproductive growth stages) exhibited reduced infection efficiency, lesion size and sporulation when compared with those observed on younger rice plants (vegetative growth stages). This report support to this finding that describe the disease progress of rice blast in Mangalpur, in that the peak incidence of leaf blast occurs at the end of the vegetative growth stages and that the rice plant becomes increasingly resistant to rice blast (resulting in less disease) as the rice plant approaches physiological maturity.

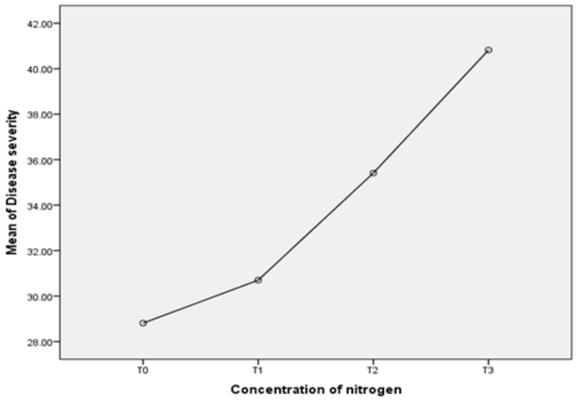


Figure 9: Relationship between total AUDPC and Grains per panicle at experimental site.

Yield and damage pattern

Maximum biological yield was given by the plot treated with no treatment (5.217 t/ha), followed by required amount of nitrogen treatment (100 kg/ha), moderate concentration of nitrogen (200 kg/ha) and high concentration of nitrogen (300 kg/ha) showed 4.083 t/ ha, 3.687 kg/ha and 2.887 kg/ha (Fig. 8). This is due to the increase in the concentration of nitrogen and resistivity of plant to the blast disease. Nitrogen supply influences branching and leaf expansion which together determines the canopy size and a large canopy is conductive to spore transfer and pathogen infection than in sparse canopies. Also fertilization with N increases host tissue susceptibility. So the increase of N application increases disease severity and results to the decrease in yield and yield attributes. Similar result has been shown by Dos Santos et al., (1986).

Rice blast disease severity and its effect on yield and yield attributes i.e. panicle length, flag leaf length, grains per panicle and test weight (1000 grain weight) were assessed during the field experiment. There was significant effect of various treatments on grains per panicle. The lowest grains per panicle of rice was observed on high concentration of nitrogen than all treatments (122.02) while the highest significant grains per panicle of rice was observed on no N treatment than all treatments (182.30) (Figure 11).

There was significant effect of various treatments on test weight. The mean value of test weight of rice on high concentration of nitrogen is lowest than all treatments (23.53 gm.) while the mean value of test weight of rice on no treatment is highest than all treatments (32.45 gm.) (Figure 12). Although several research findings have proved that highest yield and yield attributes are at required concentration of nitrogen but this research results it at no concentration of nitrogen and this may be due to proper sanitation of alternative hosts, overflow of water which may add the nitrogen by sweeping of urea

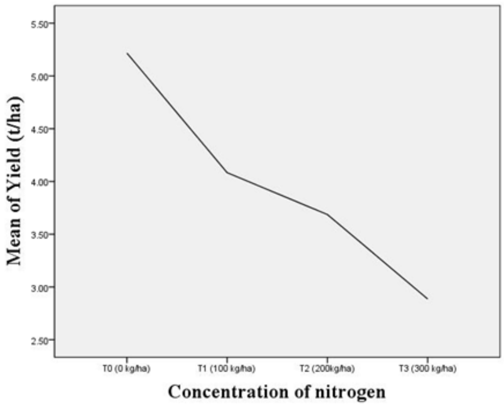


Figure 10: Mean of yield of rice affected by increase in application of N concentration.

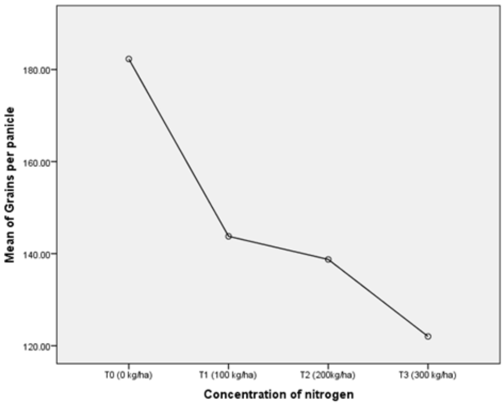


Figure 11: Mean of grains per panicle affected by increase in application of N concentration.

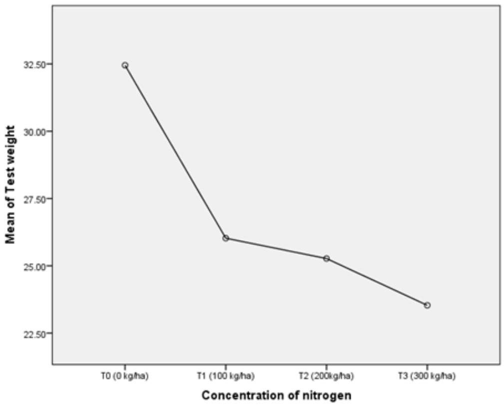


Figure 11: Mean of grains per panicle affected by increase in application of N concentration.

from other's field and resistivity of plant to leaf blast.

REFERENCE

Adhikari, T.B. and S.M. Shrestha. 1986. Blast epidemic in Chitwan valley, Nepal. *International Rice Research Newsletter, 11.*

Anwar, A., Bhat M.S., *Agr. Sci. Digest. 2005; 25(4): 293-295.*

Bonman J.M. 1992. Durable resistance to rice blast-environmental influences. *Euphytica 63: 115-123.*

Bragantia. Adubacao nirogenadae incidence de brusone em arroz de swqueiro. 2010; 69:1, 173-179.22.

Chaudhary, B. and D.N. Shah. 1998. Efficacy of Beam 75 WPin controlling leaf blast disease at the seedling stage of rice. *Nepal Agriculture Research Journal, 2: 42-47.*

Chaudhary, B. and D.N. Shah. 1997. Effect of promising rice genotypes on leaf blast disease progression. *Nepal Agriculture Research Journal, 1: 27-31.*

Chaudhary, B., P.B. Karki and K.K. Lal.1994. Neck blast resistant lines of Radha-17 isolated. *International Rice Research Notes, 19(1): 11.*

Dos Santos, A.B., Prabhu, A.B., De Aquino, A.R.L and Decarvalin, J.R.P. (1986). Effects of nitrogen rate, time and method of application on blast and grain yield in upland rice. *Pesqui. Agropecu. Bras. 21: 696-707.*

Dubey, S.C. *Indian J Agric Sci 2005; 75: 6, 367-368.9.*

Gohel, N.M., H.L. Chauhan, P.P. Choudhary, and A.N. Mehta. *Plant Dis Sci 2009; 4:2, 164-166.16 ref.*

Kurschner, E., J.M. Bonman, D.P. Garrity, M.M. Tamisin, D. Pabale, and B.A. Estrades. 1992. Effects of nitrogen timing and split application on blast disease on upland rice. *Plant Disease, St. Paul, 76: 384-389.*

Maharjan R, S. Aryal, B.P. Mainali, S. Bista, D.N. Manandhar, Y.P. Giri and R.B. Paneru, 2004. Survey on magnitude of insecticides use in crops: Proceedings of the Fourth National Workshop on Horticulture, March 2-4, 2004. Nepal Agricultural Research Council, Horticulture Research Division, Khumaltar, Lalitpur, Nepal. Pp. 291-298.

NARC, Annual Report. 1998. Nepal Agricultural Research Council, Khumaltar, Lalitpur, Nepal.

NARC, Annual Report. 2007. Nepal Agricultural Research Council, Khumaltar, Lalitpur, Nepal.

Pradhanang, P.M. 1988. Outbreak of blast disease at lumle Agricultural Centre (LAC) and its extension command area (ECA). In: Proceedings of the first national rice blast workshop. National Agricultural Research and Services Center, National Rice Research Program, PO Box 4, Birgunj, Nepal. pp. 61-69.

Roumen, E.C. 1992b. Small differential interactions for partial resistance in rice cultivars to virulent isolates of the blast pathogen. *Euphytica 64: 143-148.*

RPPL. 2001.Annual report. Regional Plant Protection Laboratory, Hariharbhawan, Nepal. 59p.

Sah, D.N. 1989. Effects of flooding and leaf wetness duration on resistance of rice lines to Pyricularia oryzae. *Journal of Institute of Agriculture and Animal Sciences 10: 41-48.*

Sah, D.N. 1993. Effect of seedbed type and nitrogen level on blast disease development in rice cultivars. *Journal of Institute of Agriculture and Animal Sciences 14: 93-96.*

Sah, D.N. and J.M. Bonman. 1992. Effects of seedbed management on blast development in susceptible and partially resistant cultivars. *Journal of Phytopathology 136: 73-81.*

Shahi, B.B. and M.H. Heu.1979. Low temperature and research activities in Nepal. In: Report of a cold Tolerance Workshop, IRRI, Los Banos, Philippines.

Pp. 61-68.

Sharma, T.R., R.S. Chauhan, B.M. Singh, R. Paul, V.S. agar, and R. Rathour. 2002. RAPD and pathotype analyses of Magneporthe grisea populations from the north-western Himalayan region of India. *Journal of Phytopathology 150: 649-656*.

Shrestha, S.M. 1993. Host ranges study and race identification of Pyricularia oryzae in Nepal. Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal. Project no. C/1554-1. 17p.

Shrestha, S.M. and L.N. Bhardwaj. 1985. Effect of seedling dates and nitrogen levels on the incidence of blast on Mansuli variety of rice at nursery stage. *Nepalese Journal of Agriculture 16: 124-128*.

Thapa, B.J. and H.K. Manandhar. 1985. Performance of differential, resistant gene donor and recommended rice cultivars in rice blast nursery at Khumaltar, Nepal. *Nepalese Journal of Agriculture 16: 116*.

Tirmali, A.M., S.B. Catake, Bendra N.J. Maharatrha Agri Univ 2001; 26: 197-198.